SECTION 2. AIRPLANE PERFORMANCE RULES

947. GENERAL. This section contains detailed information and guidance to inspectors and POI's on the performance rules applicable to specific airplanes. In many cases, tables and figures are provided in this section for inspectors to reference.

949. LARGE, RECIPROCATING-POWERED, TRANSPORT CATEGORY AIRPLANE PERFORMANCE. Large, reciprocating-powered, transport category airplanes must be operated under the performance rules of FAR's 121.173 through 121.187 and FAR 121.173(e) or, under FAR's 135.365 through 135.377 and FAR 135.363(g). Table 4.3.2.1 contains a summary of these rules.

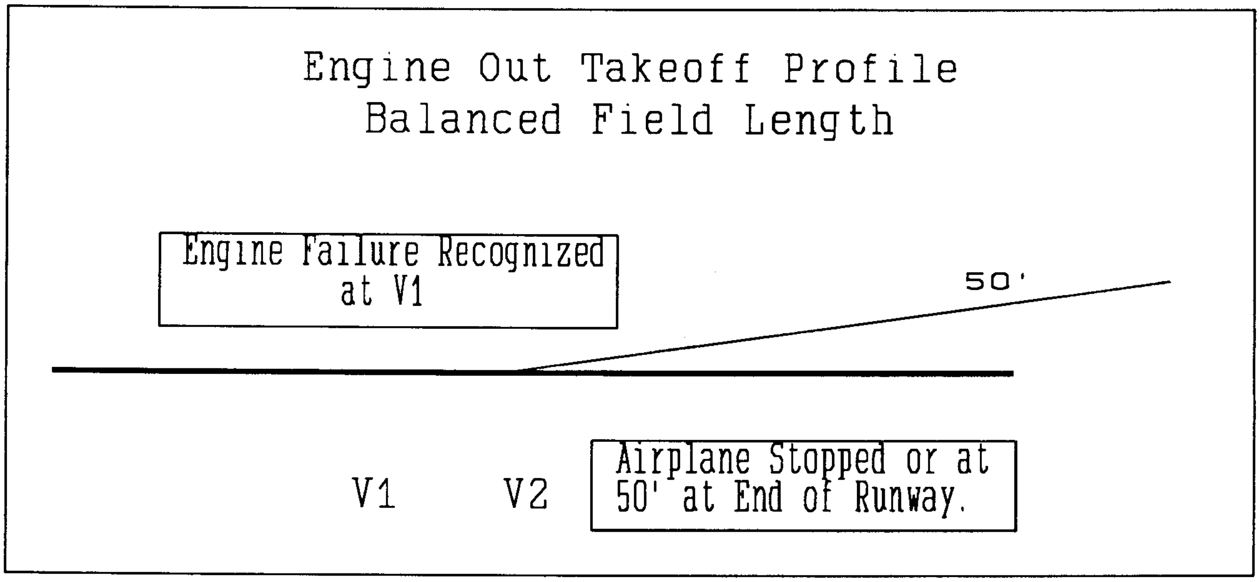
TABLE 4.3.2.1
SUMMARY OF DISPATCH RULES FOR LARGE RECIPROCATING POWERED TRANSPORT CATEGORY AIRPLANES

Temp. Correct.	**Yes**	**FAR 121.173(e), FAR 135.363(g)**
Structural Limits		
Maximum Taxi	**Yes**	**AFM Limit**
Maximum Takeoff	**Yes**	**AFM Limit**
Zero Fuel Weight	**Yes**	**AFM Limit**
Takeoff		
Accelerate/Stop	**Yes**	**FAR 121.177(a)(1), FAR 135.367(a)(1)**
All-Engines	**No**	
Accelerate/Go	**Yes**	**FAR 121.177(a)(2), FAR 135.367(a)(2)**
Climb Limit	**Yes**	**FAR 121.175(d), FAR 135.365(d)**
Obstacle Limit	**Yes**	**FAR 121.177(a)(3), FAR 135.367(a)(3)**
En Route Limits		
All-Engines	**Yes**	**FAR 121.179, FAR 135.369**
One-Eng. Inop	**Yes**	**FAR 121.181, FAR 135.371**
Two-Eng. Inop	**Part 25**	**FAR 121.183, FAR 135.37**
Approach Climb	**Yes**	**FAR 121.175(e), FAR 25.121(d)** **FAR 135.365(e), FAR 25.121(d)**
Landing Climb	**Yes**	**FAR 121.175(e), FAR 25.119** **FAR 135.365(e), FAR 25.119**
Max. Landing Wt.	**Yes**	**AFM Limit**
Runway Limit		
Destination	**Yes**	**FAR 121.185, FAR 135.375**
Alternate	**Yes**	**FAR 121.187, FAR 135.377**

A. *Ambient Temperatures.* FAR 121.173(e) and FAR 135.363(g) require that takeoff performance must be corrected for ambient temperatures. The correction factor is usually published in the flight manual as a specific number of feet to be added to the takeoff distance at a specific elevation for higher-than-standard temperatures or as a specific number of feet to be subtracted for lower-than-standard temperatures.

B. *Runway Limits.* A large, reciprocating-powered transport category aircraft must be able to accelerate to V1, lose the critical engine, and then stop on the remaining runway or, continue on the runway to V2, lift-off, and cross the effective end of the runway at not less than 50 feet. Clearways and stopways are not authorized. There is no requirement to compute an all engines operating takeoff distance.

FIGURE 4.3.2.1.



C. *Balanced Field Length.* For any given takeoff condition (gross weight, elevation, temperature) the controlling accelerate-stop distance or accelerate-go distance will be shortest when V_1 is chosen so that these two distances are equal (balanced). Most operators of reciprocating-powered airplanes choose V_1 to produce a balanced field length.

D. *Takeoff Climb Limit.* The following takeoff flightpath is used to establish the takeoff climb limit weight:

(1) The first segment of the flightpath extends from the beginning of the takeoff roll to 50 feet over the end of the runway. The critical engine is assumed to fail at V_1, and the airplane continues to accelerate to V_2 on the runway. The airplane then climbs at V_2 with the gear extended and the propeller on the failed engine either wind-milling or stopping by an auto feather mechanism (no pilot action allowed). The airplane may be banked 5 degrees away from the failed engine. The airplane must be capable of climbing at a rate of 50 feet per minute in this configuration.

(2) The second segment starts at 50 feet. The landing gear is assumed to have reached the retracted position. This segment ends at 400 feet. The rate of climb must be at least .046 times V_{s1} squared, expressed in feet per minute. For a V_{s1} of 50, the following formula applies:

$$(.046 * [50]^2)$$

$$(.046 * 2{,}500) = 115 \text{ FPM}$$

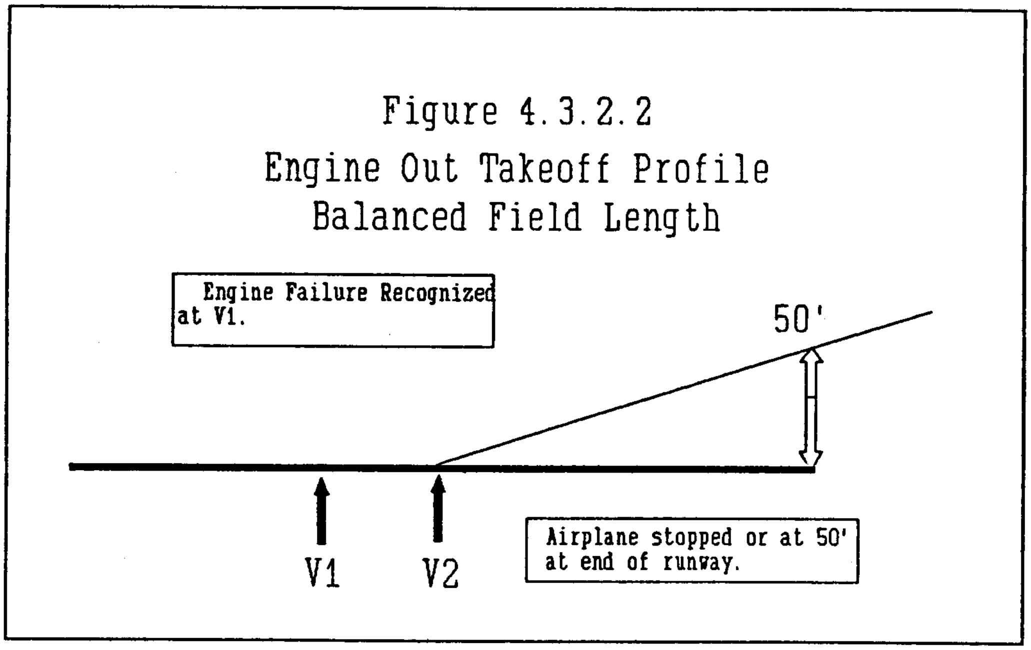
(3) The third (final segment) begins at 400 feet. The propeller is feathered, the cowl flap is closed on the failed engine, the flaps are set to the en route climb position, and the power on the operating engine(s) is set to MCT. This final segment ends when the en route climb configuration has been achieved, but at not less than 1,000 feet above the runway surface. The rate of climb in the final segment must be ($[.079 - .106/N] * V_{so}^2$), with N representing the number of engines. For a two-engine airplane with a V_{so} of 50, the following formula applies:

$$([.079 - .106/2] * 50^2)$$

$$([.079 - .053] * 2500)$$

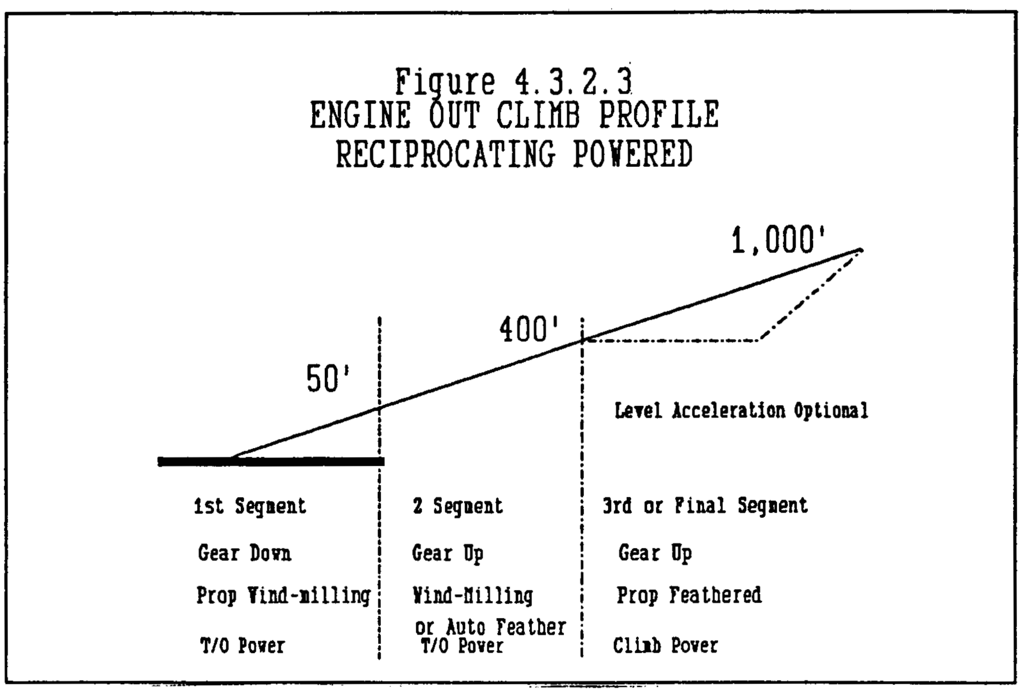
$$(.026 * 2{,}500) = 65 \text{ FPM}$$

FIGURE 4.3.2.2.



E. *Obstacle Limits.* The airplane must be able to clear all obstacles in the takeoff path by 50 feet with the critical engine failed. A "net gradient" is not used and the clearance required is 50 feet at all points throughout the takeoff path. A bank may be used once the airplane reaches 50 feet above the runway surface.

FIGURE 4.3.2.3.



F. *All-Engines Operating En Route Limit.* Airplanes certified under CAR 4A and subsequent rules must be able to climb at a rate of 6.9 V_{so} (in feet per minute) at an altitude of 1,000 feet above all obstacles within 10 miles on either side of the intended track. For a power-off stall speed of 50, the required rate is 345 feet per minute (6.9 X 50). There is no similar limitation for airplanes certified under CAR 4A or previous rules.

G. *Engine-Out En Route Limit.* At an altitude of 1,000 feet above all obstacles within 10 miles of the course to be flown, the airplane must be able to climb at a rate specified as follows:

(1) Airplanes certified under CAR 4B must be able to climb at .079-(.106/N) V_{so}^2, expressed in feet per minute, where N is the number of engines. For a four-engine airplane with a stall speed of 100, the following formula applies:

$.079\text{-}(.106/4)100^2$ and

$.079\text{-}.0265 * 10{,}000$ and

$.0525 * 10{,}000 = 525$ FPM

(2) Airplanes certified under CAR 4A must be able to maintain a rate of climb of $.026V_{so}^2$, expressed in feet per minute. For an airplane with a stall speed of 50, the following formula applies:

$.026*50^2 = 65$ FPM

(3) Instead of meeting the climb requirement, the operator may substitute an approved diversion. The procedure must be approved by the POI and published in a CFM or a portion of the GOM. When an operator proposes such a procedure, the airplane must be able to maintain an altitude of 2,000 feet above any obstacle within 5 miles of track after the assumed failure. The rate of climb used to show this capability must be taken from the AFM and diminished by .079-[.106/N]V_{so}^2 for CAR 4B airplanes or by .026 V_{so} for CAR 4A airplanes to compute a net gradient. The operator's proposed procedure must define a point at which the airplane is assumed to pass over the critical obstacle. The operator's procedure must define this point by means of an approved navigational fix. The airplane must also be able to meet the required rate of climb at an altitude of 1,000 feet above the alternate airport. The procedure must provide an account of winds and temperatures forecast in the area. Fuel may be jettisoned to meet these requirements. An en route alternate airport to which the airplane could divert, which meets the prescribed weather minimums, must be specified on the flight release when these procedures are used.

NOTE: Inspectors must be aware that an operator's compliance with the requirements described in this subparagraph G does not relieve the operator with having to comply with FAR 135.181. The FAR 135.181 engine out en route performance limit can be more restrictive than the limitations described in this paragraph.

H. *Two-Engine Inoperative En Route Limit.* Airplanes certified with four or more engines under Part 25 may not be operated more than 90 minutes away (measured at normal, all- engine cruise speed) from a suitable alternate airport unless the airplane is capable of climbing at .013 V_{so}^2 with the two critical engines failed at an altitude of 1,000 feet above the highest terrain or obstruction within 10 miles on either side of the intended track or 5,000 MSL, whichever is higher.

(1) The engines are assumed to fail at the most critical point with respect to the takeoff weight.

(2) Normal consumption of fuel and oil is assumed in computing weight at the point of the assumed failure.

(3) When the airplane must drift down after the engine failures, the airplane does not have to be capable of the required climb performance until it reaches the minimum altitude. A net flightpath is computed during the driftdown period by subtracting $.013V_{so}^2$ from the rate of descent shown in the AFM or other approved data.

(4) If the operator elects to jettison fuel to comply with this rule, enough fuel must remain after jettison to allow the airplane to proceed to a suitable alternate airport and to arrive 1,000 feet directly over the airport. Designated en route alternate airports must be listed on the flight release.

I. *Approach to a Landing Climb.* A reciprocating-powered, transport category aircraft must be able to climb at a rate of $.053V_{so}^2$ expressed in feet per minute in the approach configuration. In the landing configuration, the airplane must be able to climb at a rate of $.092V_{so}^2$.

J. *Landing Distance Limitations.* For dispatch planning, reciprocating-powered airplanes must be able to land within 60% of the effective runway at the destination. A flight may also be dispatched to a destination at which the airplane can land within 70% of the effective runway, if the designated alternate airport is one at which the airplane can land within 70% of the effective runway distance.

951. LARGE, TURBINE-POWERED TRANSPORT CATEGORY AIRPLANE PERFORMANCE. Large, turbine-powered (turbojet and turboprop) airplanes must be operated under the performance rules in FAR 121.189 through FAR 121.197 or FAR 135.379 through FAR 135.387, as applicable.

TABLE 4.3.2.2
SUMMARY OF DISPATCH RULES FOR LARGE, TURBINE POWERED TRANSPORT CATEGORY AIRPLANES

Temp. Correct.	No	Data at Ambient Temp.
Structural Limits		
Maximum Taxi	Yes	AFM Limit
Maximum Takeoff	Yes	AFM Limit
Zero Fuel Wt.	Yes	AFM Limit
Takeoff Weights		
Accelerate/Stop	Yes	FAR 121.189, FAR 135.379
All-Engines	Yes	FAR 121.189, FAR 135.379
Accelerate/Go	Yes	FAR 121.189, FAR 135.379
Obstacle Limit	Yes	FAR 121.189, FAR 135.379
Climb Limit	Yes	FAR 121.189, FAR 135.37
En Route Limits		
All-Engines	No	
One-Eng. Inop	Yes	FAR 121.191, FAR 135.381
Two-Eng. Inop	Yes	FAR 121.193, FAR 135.383
Approach Climb	Yes	FAR 121.195(a), FAR 25.121(d) FAR 135.385(a), FAR 25.121(d)
Landing Climb	Yes	FAR 121.195(a), FAR 25.119 FAR 135.385(a), FAR 25.119
Max. Landing Weight	Yes	AFM Limit
Runway Limit		
Destination	Yes	FAR 121.195, FAR 135.385
Alternate	Yes	FAR 121.197, FAR 135.387

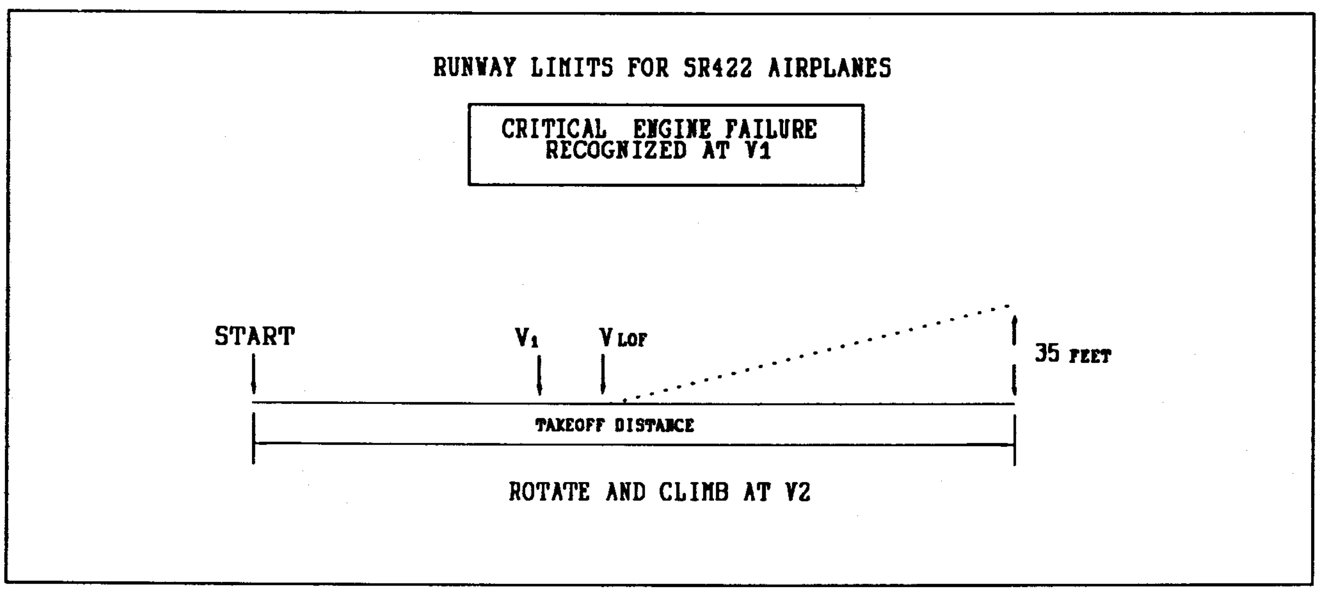
FIGURE 4.3.2.4
VARIATIONS IN TURBINE AIRPLANE TAKEOFF PERFORMANCE

```
CAR 4           SR422               SR422A              SR422B              FAR 25
11/45           8/57                7/58                7/59                2/65

CLIMB
 <--Rate of climb-><--------------------Climb computaions based on gradient ----------------------------->
ALL ENGINES T/O DISTANCE
 <--------------Not computed------------><----------------115% All engines Takeoff distance------------->
V2
 <-On Ground------><-----Near Ground-----><-----------------Vr used and V2 reached at 35' ---------------->
CLEARWAYS and STOPWAYS
 <----------------No Clearway -----------><--Level Clearway-----><-Sloping Clearway, Max. 1/2 runway------>
                                         Max.  1/2 T.O. Run
 <----------Balanced Field Length--------><----------------------Unbalanced Field Length----------------->
 <----------------No Stopways------------><------------------------------Stopways----------------------->
TAKEOFF CLIMB SEGMENT
 <----------------1,000 Feet------------><-------------1,500 Feet above runway surface------------------>
OBSTACLE CLEARANCE
 <--------50 Feet at all points---------><----.1 X Dist. +35'--><-----------Net Path + 35 ft.----------->
```

A. *Runway Limits for SR 422 Airplanes.* Only accelerate-stop and accelerate-go distance computations are required to determine takeoff distances for airplanes certified under SR 422. In the accelerate-go computation, SR 422 airplanes must lift-off (V_r is not computed or used). The accelerate-go distance is measured to the point the airplane reaches 35 feet above the runway surface. Clearways and stopways are not allowed. The airplane must cross the end of the runway at or above 35 feet.

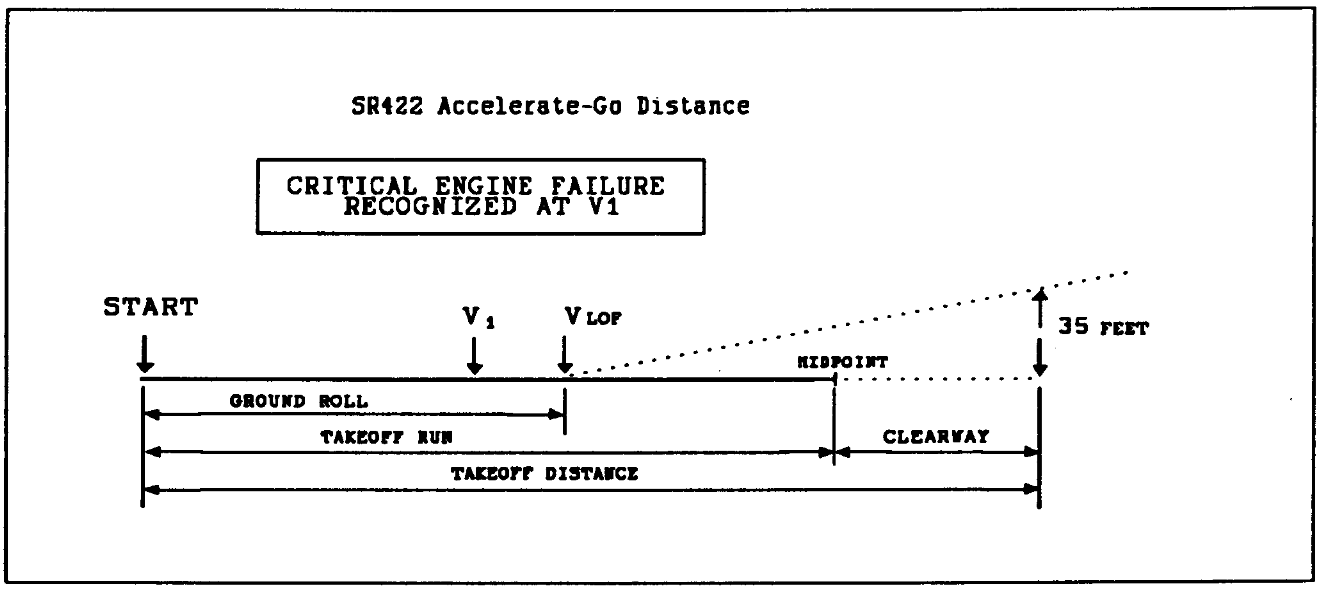
FIGURE 4.3.2.5.



B. *Runway Limits for SR 422A Airplanes.* The takeoff distance for airplanes certified under SR 422A is the longer distance among the 115% all-engines takeoff distance, the accelerate-stop distance, and the accelerate-go distance. The nosewheel is lifted off the ground at Vr which is calculated so that V_2 is reached as the aircraft becomes airborne. Clearways may be used but stopways are not allowed. A clearway under SR 422A is an area beyond the runway that is centrally located around the extended centerline and is under the control of airport authorities. A clearway extends 300 feet on either side of the extended runway centerline at the runway elevation, and into which only runway lights of 26 inches or less height may intrude. The maximum clearway distance may not exceed one half of the takeoff run distance.

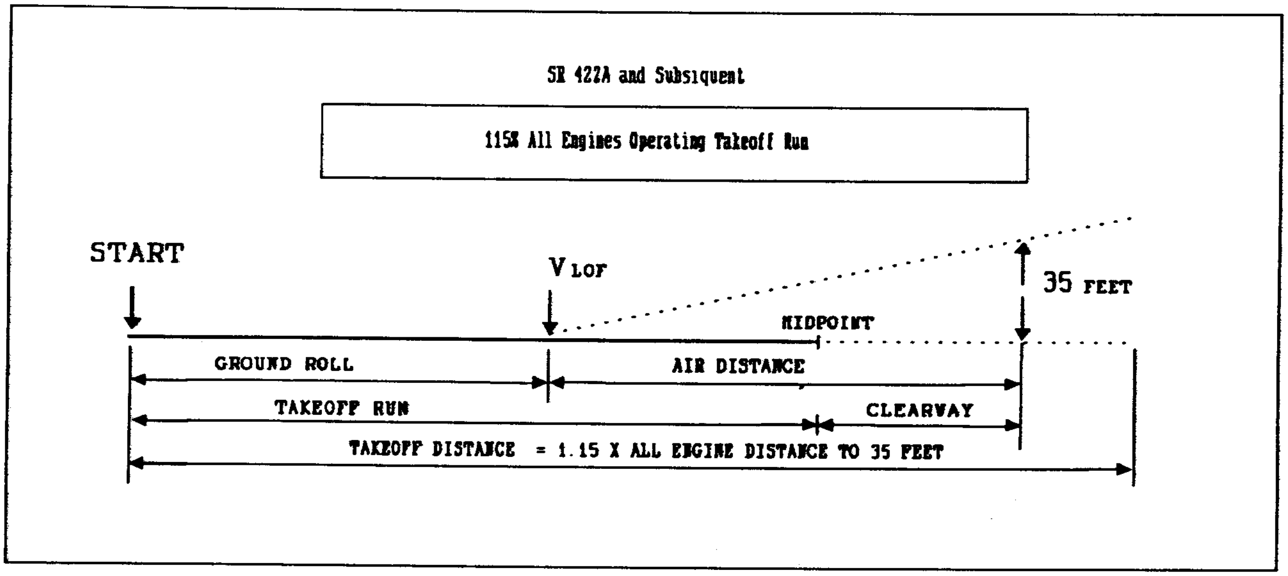
C. *SR 422A and Subsequent Accelerate-Go Distance.* The accelerate-go distance is measured from the start of the takeoff roll to the point at which the aircraft reaches 35 feet above the runway elevation. This point may be over the clearway. Failure of the critical engine is recognized at V_1.

FIGURE 4.3.2.6.



D. *SR 422A and Subsequent 115% All-Engines Takeoff Distance.* The 115% all-engines takeoff distance is the distance from the start of the takeoff run to the point the airplane reaches 35 feet above the runway elevation, plus an additional 15%. This point must be over the runway or the clearway.

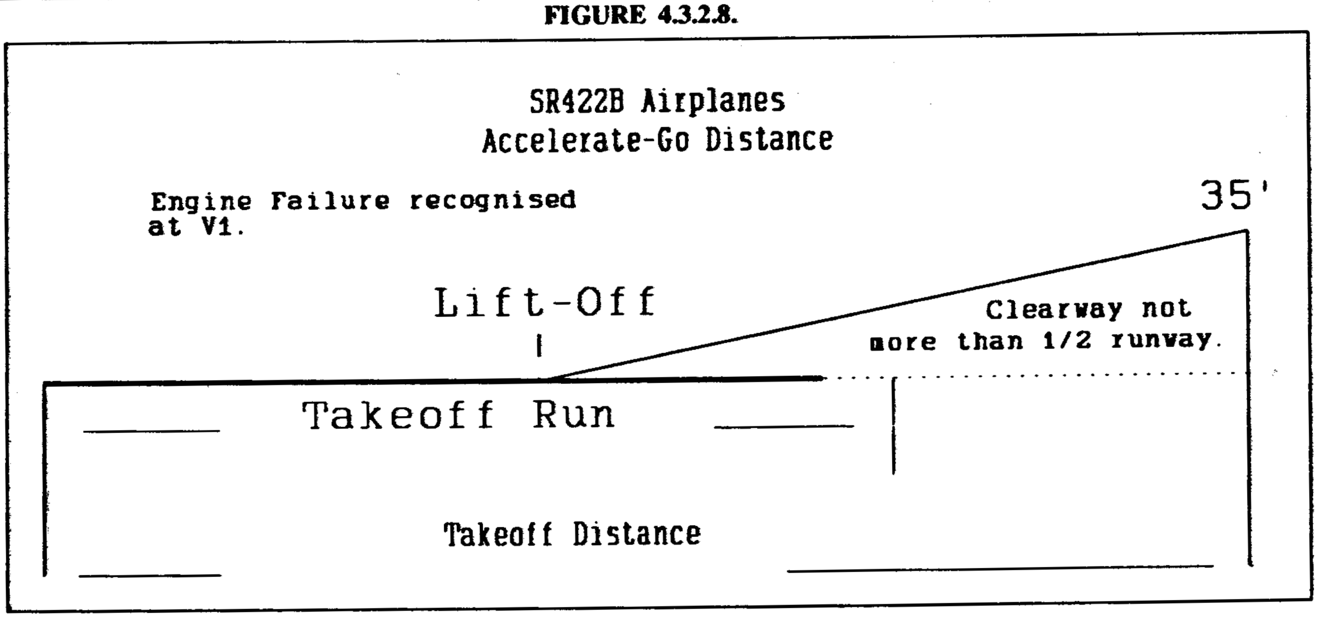
FIGURE 4.3.2.7.



E. *SR 422A and Subsequent Takeoff Run.* If the takeoff distance is computed using a clearway, the takeoff run is the longer of two distances, either the accelerate-go takeoff run distance or the 115% all-engines takeoff run distance.

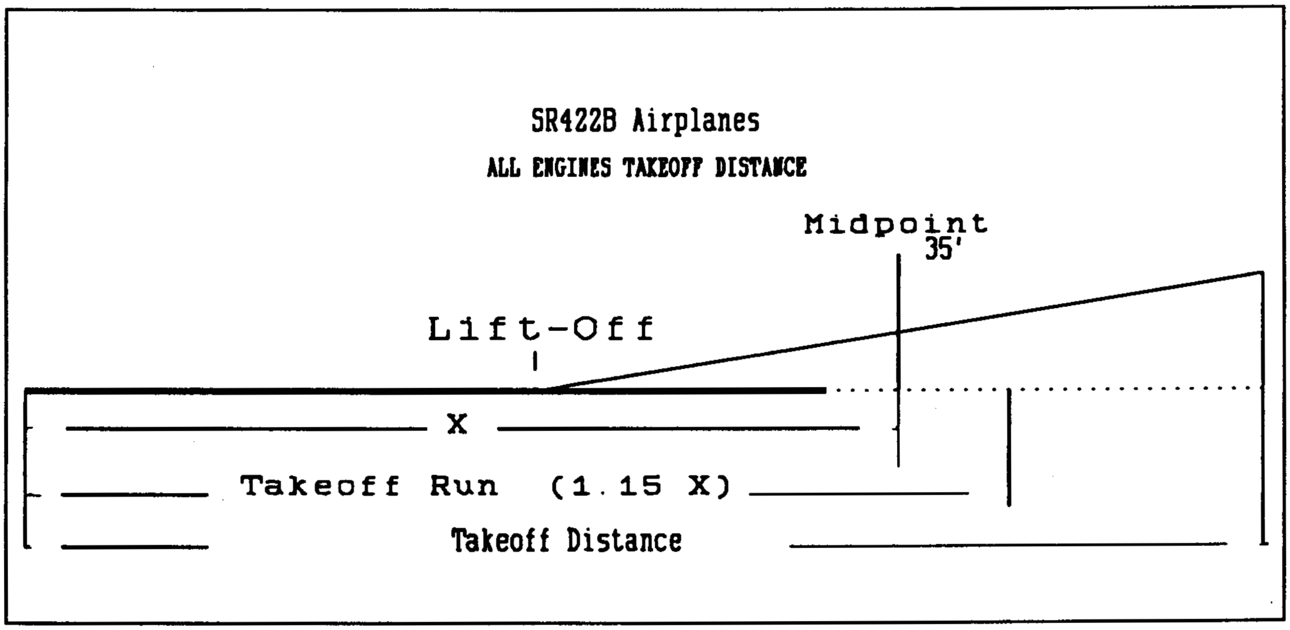
(1) *Accelerate-Go Takeoff Run.* The accelerate-go takeoff run distance is measured from the start of the takeoff roll to a point equidistant from the point at which lift-off occurs to the point at which the airplane reaches 35 feet above the surface. The critical engine is assumed to fail at V_{ef} with recognition V_1. The end of the takeoff run must be on or over the runway.

FIGURE 4.3.2.8.



(2) *115% All-Engines Takeoff Run.* The 115% all-engines takeoff run is calculated by measuring from the start of the takeoff roll to the point midway between the lift-off point and the point at which the airplane reaches 35 feet above the runway surface and by then adding 15%. The takeoff run must be on or over the runway surface.

FIGURE 4.3.2.9.



NOTE: To simplify clearway computations, the maximum allowable clearway is normally stated by the manufacturer as a specified number of feet for a given runway length.

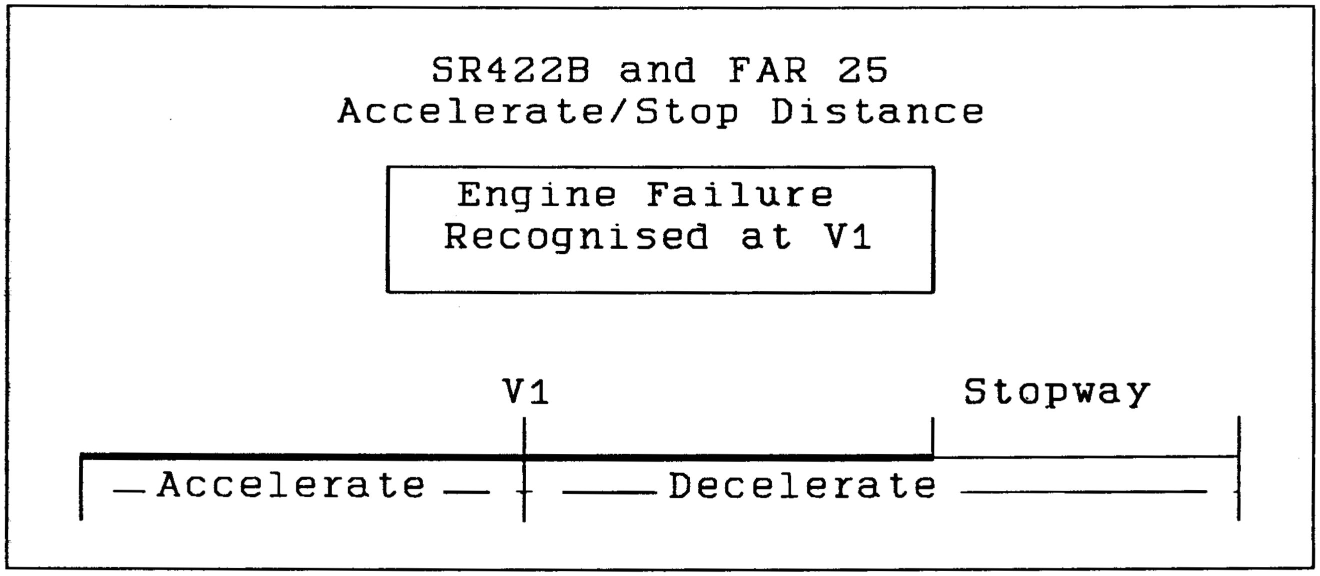
F. *Stopways.* For SR 422B and Part 25 airplanes, a stopway may be used to extend the effective runway length when computing the weight limited by the accelerate-stop distance. A stopway is an area beyond the runway, at least as wide as the runway, that is centrally located about the extended centerline of the runway, and designated by the airport authorities for use in decelerating the airplane during a refused takeoff. A stopway must be capable of supporting the airplane without inducing structural damage. The surface characteristics of the stopway may not differ substantially from those of a smooth, dry, hard surface runway. The airplane must be able to accelerate to V_1, to experience an engine failure, and then to lift-off on the actual runway surface

G. *Unbalanced Field Length.* The 115% all-engines takeoff distance is usually the controlling distance for SR 422A and subsequent airplanes. A V_1 selected to achieve a balanced field length usually exceeds V_r, a condition which is not allowed by the regulations. For these airplanes, V_1 is normally selected as identical to V_r and the balanced field length concept is not applicable.

H. *Climb Limit Weights.* The takeoff weight of large, turbine-powered airplanes must be limited to allow the aircraft to climb at a specified gradient through each of the defined climb segments of the takeoff flightpath. The climb segments are defined as follows:

(1) The first climb segment starts from lift-off to the point at which the landing gear is retracted, but not

FIGURE 4.3.2.10.



less than 35 feet above the runway. Airplanes certified under SR 422 and subsequent rules must attain V_2 speed before exceeding 35 feet above the runway surface. Airplanes certified under SR 422 must attain V_2 speed as they leave the ground.

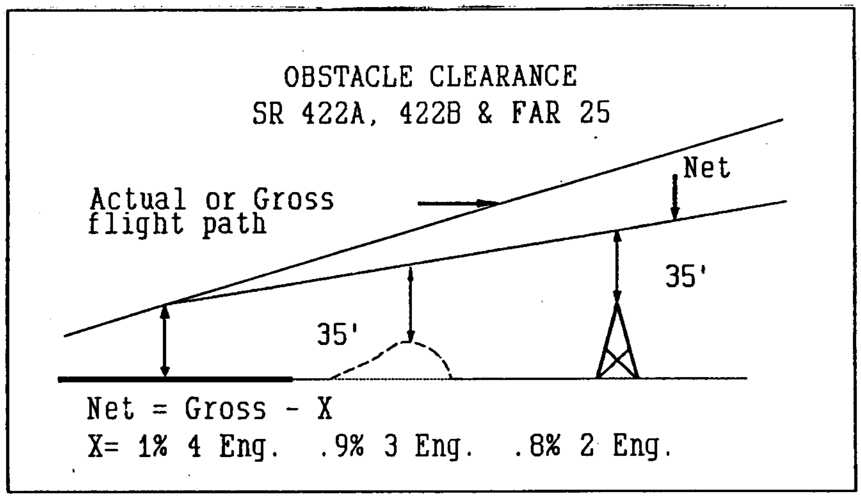
(2) The second climb segment starts when the gear is retracted or at 35 feet, whichever is later, and continues at V_2 until the selected acceleration height (not less than 400 feet above the runway).

(3) The third and final climb segment starts at the acceleration height and continues until the transition to the en route configuration is complete (not lower than 1,000 feet above the runway for SR 422 airplanes and 1,500 feet above the runway surface for SR 422A and subsequent aircraft). The en route speed at the end of the transition segment may not be less than 125% of V_s. The final segment (at the operator's option) may be divided into third and fourth segments. The aircraft may fly level in the third segment (no negative slope allowed), and then accelerate and resume the climb in the fourth segment. The overall gradient, however, is measured from the end of the second segment to the end of the final segment.

I. *Obstacle Clearance Net Flightpath SR 422A, SR 422B and Part 25.* The net takeoff flightpath for SR 422A, SR 422B, and Part 25 airplanes is derived by subtracting an increment from the actual path the airplane can fly (gross flightpath). The increment is 1% for four-engine airplanes, .9% for three-engine airplanes, and .8% for two-engine airplanes. The net flightpath begins at the point the airplane reaches 35 feet above the runway and must pass not less than 35 feet over each obstacle. The use of a net flightpath has the effect of adding 10 feet for four-engine airplanes, 9 feet for three-engine airplanes, and 8 feet for two-engine airplanes with obstacle clearance for each 1000 feet of distance traveled from the end of the runway.

J. *Obstacle Clearance SR 422 Airplanes.* The net flightpath for SR 422 airplanes is computed by multiplying the distance traveled from the end of the runway to the obstacle by 1.01 and by then adding 35 feet.

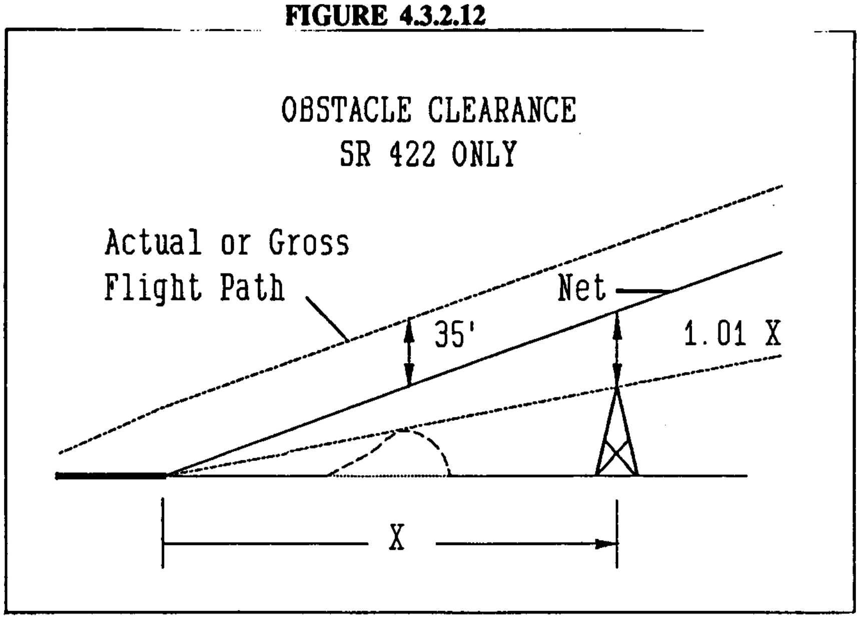
FIGURE 4.3.2.11.



K. *One-Engine Inoperative En Route Performance.* Turbine-powered, transport category airplanes must, at all points along the intended route after an engine fails, be able to clear all terrain and obstructions by 1,000 feet that are within 5 statute miles on either side of the intended track. This requirement must be met at the forecast temperature for the required altitudes at the planned time of the flight.

(1) One means of complying with this rule is to limit the takeoff gross weight so that, considering fuel burn, the aircraft will be light enough to ensure the necessary performance over the most critical point on the route. When the rule is applied in this way, it must be shown that the airplane can at least fly level with one engine inoperative at an altitude of at least 1,000 feet above the terrain and 1,500 feet above the destination

FIGURE 4.3.2.12



airport, using net flightpath data. In this case, the net flightpath is derived by subtracting 1.6% gradient for four-engine airplanes, 1.4% for three-engine airplanes, and 1.1% for two-engine airplanes from the actual climb performance the airplane can produce. Thus, the net climb gradient capability remains a performance margin at the weight, altitude, and temperature anticipated at the critical point on the route.

(2) Takeoff gross weights higher than those obtained by the method in subparagraph (1), may be achieved by fuel jettison or driftdown. When fuel jettison or driftdown is used, the operator must show that the net flightpath available after engine failure would permit the airplane to clear all terrain by at least 2,000 feet while cruising, or when drifting down to an alternate airport within range of the fuel remaining after jettison. An SR 422 airplane must have enough fuel after jettison to reach a point overhead the planned alternate airport. At the planned arrival weight, the airplane must be capable of maintaining a positive climb gradient at an altitude of 1,000 feet above the designated airport. An SR 422A airplane, an SR 422B airplane, or a Part 25 airplane must have enough fuel after jettison to reach the alternate airport and to then fly an additional 15 minutes. The airplane must be capable of maintaining a positive climb gradient at an altitude of 1,500 feet above the designated airport. The prevailing wind and temperature forecast must be taken into account in the area. An en route alternate airport to which the airplane is assumed to divert (at which the weather is forecasted to meet the prescribed weather minimums), must be specified on the flightplan and clearance forms.

(3) POI's should be aware that the engine-out, en route performance limit is particularly critical for two-engine airplanes operated in the mountainous portions of the western contiguous United States and Alaska. POI's must exercise particular care when evaluating this element of an operator's program.

L. *Two-Engines Inoperative En Route.* Any flight during which the airplane is not at all times within 90 minutes of a suitable landing area (measured at normal, all-engines cruise speed), must be assumed to have had a double-engine failure occur at the most critical point along the route. The airplane must be able to reach an alternate airport from this point. Any airport that has sufficient runway length to accommodate the 60% alternate landing requirements may be considered suitable. When establishing the weight limitations to comply with this rule, the takeoff weight is reduced by the normal en route fuel consumption of all engines. Then, at the critical point, two-engines are assumed to fail simultaneously.

FYI: Twin engine, extended-range jet transport operations (ETOPS) will be included at a later date.

(1) For SR 422 airplanes, the airplane must be able to maintain a positive slope at an altitude of 1,000 feet above all terrain or obstacles and within 5 miles on either side of the intended track, or at 5,000 feet MSL, whichever is higher.

(2) For SR 422A airplanes, the airplane must be able to maintain a positive slope of 1,000 feet above all obstructions for 5 miles on either side of the intended track, or at 2,000 MSL, whichever is higher.

(3) For SR 422B and Part 25 airplanes, the airplane must be able to clear all obstructions for 5 miles on either side of the intended track by 2,000 feet vertically.

(4) When the planned airplane takeoff weight exceeds that determined according to the preceding subparagraphs (1), (2), or (3), fuel jettison may be used. The net flightpath must have a positive slope at 1,000 feet above the airport where the landing is assumed to be made for SR 422 airplanes and at 1,500 feet for SR 422A and subsequent airplanes.

(5) SR 422 airplanes must have sufficient fuel after jettison to be able to reach the en route alternate airport. SR 422A and subsequent airplanes must be able to fly for 15 minutes at cruise power after reaching the designated alternate airport. Designated en route alternate airports must be listed on the dispatch release and on the FAA flightplan.

M. *Approach Climb.* Airplane weight during approach must be planned so that a specified gradient of climb is available with one-engine inoperative, at takeoff thrust, and at the temperature forecasted to exist on arrival. The flap angle used to establish approach climb-out performance must be chosen so that the stall speed with this flap setting will not exceed 110% of the stall speed with landing flaps. The climb speed used must not exceed 150% of the approach stall speed. The specified climb gradient must be the following:

- 2.7% or better for four-engine airplanes
- 2.4% or better for three-engine aircraft
- 2.1% or better for two-engine airplanes

N. *Landing Climb*. For release, the weight of the airplane (allowing for normal en route fuel and oil consumption) must result in a landing approach weight at which the airplane can climb at a gradient of 3.2% or better. Landing climb gradient is measured with all engines operating at the thrust available 8 seconds after the initial moving of the throttles from idle to takeoff position. The flap setting used to establish landing climb-out performance is usually the full-down position. The speed used must not exceed 130% of the stall speed in this configuration.

O. *Landing Distance Limitations.* For release, turbine airplanes must conform to the following limitations:

(1) Turbojets must be able (allowing for normal en route fuel and oil consumption) to land within 60% of the effective runway at both the destination and the alternate airports.

(2) Turbopropeller airplanes must be able to land within 60% of the effective runway at the destination and 70% at the alternate airport.

(3) A flight may be dispatched which cannot meet the 60% runway requirement at the destination if an alternate airport is designated where the flight can land within the distance specified for an alternate airport.

(4) When a runway is forecasted to be wet or slippery at the destination, 15% must be added to the required landing runway length. A correction is not applied to the alternate landing runway length for pre-flight planning.

953. PERFORMANCE RULES FOR LARGE NON-TRANSPORT AIRPLANES. A large nontransport airplane may only be operated under the performance rules of FAR 121.199 through FAR 121.205 or of FAR 135.363 and FAR 135.389 through FAR 135.395.

TABLE 4.3.2.3.
SUMMARY OF DISPATCH RULES FOR LARGE NONTRANSPORT CATEGORY AIRPLANES

Temperature Correction	No	FAR 121.199(b)(4) FAR 135.389(b)(4)
Structural		
Max. Takeoff	Yes	AFM or Placard
Zero Fuel	No	
Takeoff		
Accelerate/Stop	Yes	FAR 121.199(a), FAR 135.389(a)
All-Engines	No	
Accelerate/Go	No	
Climb Limit	No	
Obstacle Limit	No	
En Route Limits		
All-Engines	No	
One-Eng. Inop	Yes	FAR 121.201, FAR 135.391, FAR 135.181
Two-Eng. Inop	No	
Zero Fuel Wt.	No	
Approach Climb	No	
Landing Climb	No	
Max. Landing	Yes	AFM or Placard
Runway Limit		
Destination	Yes	FAR 121.203, FAR 135.393

A. *Standard Temperatures.* Takeoff performance for large nontransport airplanes may be based on standard temperatures without correction for ambient conditions.

B. *Runway Limit.* The airplane must be capable of stopping on the remaining runway at any point up to 105% of V_{mca}, or 115% of V_g, whichever is greater. Wind and the runway gradient must be considered if they adversely affect performance. Effective runway length is defined as the intersection of the rollout end of the runway and the 20:1 obstacle clearance plane or the end of the runway surface, whichever is shorter. The airplane must cross the effective end of the runway at 50 feet above the runway elevation feet with the critical engine inoperative.

C. *En Route Climb Limit Weight.* The airplane must be able to climb at 50 feet per minute at an altitude of 1,000 feet above the highest obstacle, within 5 miles on either side of the intended route or 5,000 feet MSL (whichever is higher), with the critical engine inoperative. POI's may approve a driftdown procedure instead of this requirement. During driftdown, the airplane must be able to clear all terrain within 5 miles of the course by 1,000 feet, based on assuming a descent rate of 50 feet per minute greater than the figure in the approved performance data. Before approving such a procedure, the POI shall consider the following factors:

- Reliability of wind and weather forecasts in the area

- Location and availability of navigational aids
- Prevailing weather conditions in the area (particularly the frequency and amount of turbulence in the area)
- Terrain features
- Possible air traffic control problems

NOTE: Operator compliance with the requirements described in this paragraph does not relieve a Part 135 operator of having to comply with FAR 135.181. The engine-out en route requirements of FAR 135.181 can be more limiting than the restrictions described in this paragraph.

D. *Approach and Landing Climb Limit Weights*. There are no approach or landing climb limits required by Subpart I of Part 121 or Part 135.

E. *Destination and Alternate Runway Limits Weight.*

For release, the airplane must be able to land within 60% of the effective runway length at the destination and within 70% of the effective length of the alternate runway.

955. RULES FOR RELEASE OF COMMUTER CATEGORY AIRPLANES. Commuter category airplanes must be operated under the performance rules in FAR 135.363 and FAR 135.398.

TABLE 4.3.2.4.
SUMMARY OF DISPATCH RULES FOR
COMMUTER CATEGORY AIRPLANES

Temp. Corr.	No	(Ambient temp. in AFM data.)
Structural Limits		
Max. Taxi Wt.	Yes	AFM & FAR 135.398(a)
Max. Takeoff Wt.	Yes	AFM & FAR 135.398(a)
Zero Fuel Wt.	Yes	AFM & FAR 135.398(a)
Takeoff Weight		
Accelerate/Stop	Yes	FAR 135.398(a), FAR 23.25(a), & FAR 23.55
All-Engines	Yes	FAR 135.398(a), FAR 23.25(a), & FAR 23.1583(c)(3)(i)
Accelerate/Go	Yes	FAR 135.398(a), FAR 23.25(a), & FAR 23.1583(c)(3)(ii)
Climb Limit	Yes	FAR 135.398(a), FAR 23.25(a), & FAR 23.1583(c)(3)(iii)
Obstacle Wt.	Yes	FAR 135.389(b)
En Route Limits		
All-Engines	No	
One-Eng. Inop	Yes	FAR 135.381
Overwater	Yes	FAR 135.383
Approach Climb	Yes	FAR 135.398(c), FAR 135.385(a)
Landing Climb	Yes	FAR 135.389(c), FAR 135.385(a)
Max. Landing Wt.	Yes	AFM & FAR 135.389(c)
Runway Limit		
Destination	Yes	FAR 135.385(b), (c), or (d)
Alternate	Yes	FAR 135.387

A. *Runway Takeoff Weight Limits.* These rules parallel the rules for large, turbine-powered airplanes certified under Part 25. Takeoff weight must be limited to the lowest weight allowed by the following:

- Accelerate-go
- Accelerate-stop
- 115% all-engines

B. *Climb-Limit Weights.* The climb-limit weight requirements for a commuter category airplane with the critical engine inoperative are as follows:

(1) In the first climb segment, (until the landing gear is retracted, but not less than 35 feet) the following airplane types must maintain the following gradients:

- Two-engine airplanes - a positive gradient
- Three-engine airplanes - a .3% gradient

- Four-engine airplanes - a .5% gradient

(2) The second climb segment begins at gear retraction and extends to 400 feet. During the second climb segment, the landing gear is retracted and the propeller on the failed engine is windmilling or auto-feathered (no pilot action allowed), and the following airplane types must be able to climb-out at the following gradients:

- Two-engine airplanes - a 2.0% gradient
- Three-engine airplanes - at a 2.3% gradient
- Four-engine airplanes - at a 2.6% gradient

(3) In the third and final climb segment (400 feet to 1,500 feet above the runway) the following airplane types must be able to climb at the following gradients:

- Two-engine airplanes - at a 1.2% gradient
- Three-engine airplanes - at a 1.5% gradient
- Four-engine airplanes - at a 1.7% gradient

C. *Obstacle Limits.* Commuter category airplanes must be able to clear all obstacles in the takeoff path either by 200 feet horizontally or by 35 feet vertically within the airport boundaries and 300 feet outside. A net flightpath must be used. The aircraft's actual climb-out path capability must be reduced by the following:

- .8% for two-engine airplanes
- .9% for three-engine airplanes
- 1.0% for four-engine airplanes

D. *En Route.* At takeoff weight, the airplane must be capable of maintaining a specific climb gradient at the ambient, temperature, at 5,000 MSL, and with one engine inoperative. The en route limitation of FAR 135.181 can be more restrictive.

E. *Approach Climb.* Takeoff weight must be limited so that, upon arrival at the destination or alternate airport, and with the critical engine inoperative, the following airplane types must be able to climb at the following gradients:

- Two-engine airplanes - at a 2.1% gradient
- Three-engine airplanes - at a 2.4% gradient
- Four-engine airplanes - at a 2.7% gradient

F. *Landing Climb.* Takeoff weight must be limited so that upon arrival at the destination or alternate airport, in the landing configuration, and with full power available, the airplane is able to climb at a 3.3% gradient.

G. *Landing Runway Requirements.* Takeoff weight must be limited so that, at the planned weight upon arrival at the destination airport, the airplane may land within 60% of the available runway. At the planned weight upon arrival at the alternate airport, the airplane must be able to land within 70% of the available runway.

957. SMALL TRANSPORT CATEGORY AIRPLANES OPERATED UNDER PART 135. A small transport category airplane is an airplane certified in the transport category of less than 12,500 pounds MTOW. FAR 135.363 and FAR 135.397(b) apply to small, turbine-powered airplanes and FAR 135.363 and FAR 135.397(a) to small, reciprocating-powered transport category airplanes. In summary, the dispatch performance rules for small, transport category airplanes are the same as those for large, transport category airplanes - except that operators of small, transport category airplanes are not required to be able to show that the airplane is capable of clearing obstacles in the takeoff path in the case of the loss of an engine. Part 135 operators of these aircraft are not required to maintain a runway analysis.

959. SMALL, NONTRANSPORT CATEGORY AIRPLANES WITH 10 TO 19 PASSENGER SEATS AND UP TO 12,500 MTOW. Reciprocating or turbopropeller airplanes with up to 19 passenger seats that are certified in the normal category under the provisions of the "special conditions of the administrator", Part 23, SFAR 23, or SFAR 41.1(a) have specified performance rules. To be operated with more than nine passenger seats, these airplanes must comply with the additional airworthiness requirements in Appendix A of Part 135 or the equivalent conditions in SFAR 23 or SFAR 41. These airplanes may be operated up to 12,500 pounds MTOW. See figure 4.3.2.16 in this section for a listing of the airplanes operated under these rules.

**TABLE 4.3.2.5.
SUMMARY OF DISPATCH RULES FOR SMALL,
NORMAL CATEGORY AIRPLANES
THE SPECIAL CONDITIONS, APPENDIX A, SFAR 23
OR SFAR 41, PARG. 1(a)**

Temperature Correction	No	(Ambient temperatures must be used in AFM data.)
Structural Limits		
Max. Taxi Wt.	Yes	AFM & FAR 135.399(a)
Max. Takeoff Wt.	Yes	AFM & FAR 135.399(a)
Zero Fuel Wt.	No	(Not AFM limit)
Takeoff		
Accelerate/Stop	Yes	FAR 135.399(a), App.A, Par. 5c)
All-Engines Dist.	Yes	App. A, Paragraph 5(d)
Accelerate/Go	Yes	App. A, Paragraph 5(e)
T/O Climb Limit	Yes	FAR 135.399(a), Appendix A Paragraph 6(b)
Obstacle Limit Wt.	No	
En Route Limit		
All-Engines	No	
One-Eng. Inop	Yes	FAR 135.381
Overwater	Yes	FAR 135.383
Approach Climb	No	
Landing Climb	Yes	App. A, Par. 6(a)
Max. Landing Wt.		
Sp. Cond. & SFAR 23	Yes	AFM Limit
App. A & SFAR 41.1(a)	Yes	FAR 135.399(a), FAR 23.25(a)
Runway Limits		
Destination		
Sp. Cond. & SFAR 23	No	
App. A & SFAR 41.1(a)	Yes	FAR 135.399(a)
Alternate		
Sp. Cond. & SFAR 23	No	
App. A & SFAR 41.1(a)	Yes	FAR 135.399(a)

A. *Applicable Performance Rules.* FAR 135.399 requires that these airplanes be operated within the takeoff and landing weight limitations of the AFM. Paragraph 19 of Part 135, Appendix A specifies those performance limitations which must be included in the flight handbook. A summary of these takeoff and landing weight limits follows.

(1) *Takeoff Runway Limit Weights.* The takeoff weight for each runway and temperature is limited by:

- Accelerate-stop distance

- Accelerate-go distance
- All-engines climb to 50 feet distance

(2) *Climb Limit Weights.* Takeoff weight must be limited so that the following capabilities of the airplane are required:

(a) The airplane must be capable of climbing with all engines operating, at the airport elevation, in the takeoff configuration, at 300 feet per minute.

(b) The airplane must be capable of a positive rate of climb at V1 with the gear extended and the critical engine failed.

(c) The airplane must be capable of a climb gradient of 2% at V2 with the gear retracted and the critical engine failed.

(d) The airplane must be capable of climbing to a height of 1,000 feet above the runway at V2 speed, in the takeoff configuration, with the critical engine failed.

(e) The airplane must be capable of maintaining a climb gradient of 1.2% at 1,000 feet above the runway elevation, in the en route configuration, with the critical engine failed.

NOTE: In the case of the loss of an engine, these airplanes are not required to be able to clear obstacles in the takeoff path.

(3) *En Route and Overwater Limits.* The FAR 135.181 and 135.183 restrictions apply to passenger-carrying operations.

(4) *Landing Climb Limit.* The takeoff weight must be limited so that upon arrival at the destination and the alternate airport, assuming normal fuel burn and with all engines operating, the airplane is able to climb at a 3.3% gradient.

B. *Destination and Alternate Airport Limits.* For airplanes certified under Part 135, Appendix A or SFAR 41, paragraph 1(a), the airplane must be able to land within the AFM limits. The weights shown in the AFM have been corrected to 60% of the effective runway length at the destination airport and to 70% of the effective runway length at the alternate airport.

961. RULES FOR RELEASE OF SFAR 41.1(b) AIRPLANES. SFAR 41.1(b) applies to turbopropeller and reciprocating-powered airplanes of more than 12,500 pounds, but not more than 19,000 pounds MTOW, with up to 19 passenger seats.

A. FAR 135.399 requires that these SFAR 41.1(b) airplanes be operated within the takeoff and landing weight limitations of the AFM, FAR 135.385, and FAR 135.387.

B. SFAR 41.1(b) airplanes must meet all of the requirements of paragraph 947 of this chapter and operators must adhere to the following additional requirements:

(1) A maximum zero fuel weight must be specified in the AFM.

(2) The landing computation rules must be the same as those for turbine-powered, transport category airplanes. The airplane must be able to land at the planned destination airport within 60% of the effective runway length and at the alternate airport within 70% of the effective runway length.

963. RULES FOR RELEASE OF SMALL, NORMAL CATEGORY AIRPLANES WITH LESS THAN 10 SEATS. Reciprocating or turbopropeller-powered airplanes certified in the normal category and operated under Part 135 with less than 10 passenger seats have specified rules. Small turbojet airplanes certified in the normal category are treated as if they were certified in the transport category for the purposes of Part 135 (see previous paragraph 955).

TABLE 4.3.2.6.
RULES FOR RELEASE OF SMALL, NORMAL CATEGORY AIRPLANES WITH LESS THAN 10 PASSENGER SEATS

Temperature Correction	No	AFM data shown at standard temperature.
Structural Limits		
Max. Taxi Wt.	Yes	AFM or Placard
Max. Takeoff Wt.	Yes	AFM or Placard
Max. Landing Wt.	Yes	AFM or Placard
Zero Fuel Wt.	No	(Not an AFM limit)
Takeoff		
Accelerate/Stop	No	
All-Engines	No	
Accelerate/Go	No	
Obstacle Limit	No	
T/O Climb Limit	No	
En Route Limits		
All-Engines	No	
One-Eng. Inop	Yes	FAR 135.381
Overwater	Yes	FAR 135.383
Approach Climb	No	
Landing Climb	No	
Max. Landing Wt.	Yes	AFM
Runway Limit		
Destination	No	
Alternate	No	

A. *Weight Limit.* There are no takeoff weight limits in Part 135 for these airplanes. There are both takeoff and landing weight limits in the AFM. The regulations that make the AFM limitations apply to Part 135 operations are FAR 91.31 and FAR 91.9.

B. *Takeoff Runway Limits.* There are no runway performance limits specified in either the AFM or in Part 135. Many of these airplanes have accelerate-stop distances expressed in flight manuals as advisory information. An accelerate-stop distance is a limitation only when expressed as such by the AFM. Some airplanes of the same make and model have such limitations while others do not, depending on the airplane's date of manufacture.

C. *Climb Limits.* There is no requirement that the airplane must be able to maintain a positive gradient in case of an engine failure. These airplanes are not required to be able to clear obstacles in the takeoff path in case of the loss of an engine.

D. *En Route.* The provisions of FAR 135.181 for IFR operations with passengers and the provisions of FAR 135.183 for overwater operations with passengers apply to these airplanes (see paragraph 929 of this section). Most airplanes with less than 6,000 pounds takeoff weight are unable to meet the FAR 135.181 restriction, which effectively precludes their use in planned IFR passenger operations. Multiengine airplanes with over 6,000 pounds MTOW must be able to climb at a rate (depending on temperature) specified in Part 23 with one engine out at 5,000 feet MSL. Many of these airplanes are not be able to meet the requirements of FAR 135.181 over any surface higher than sea level.

964. - 974. RESERVED.

TABLE 4.3.2.7.
CERTIFICATION AND OPERATING RULES FOR TURBOPROPELLER AND RECIPROCATING MULTIENGINE PASSENGER AIRPLANES

Airplane	Max. Pax. Seats	Certification Category & Performance Rules
Aerospatiale/Aerilati ATR 42 (series)	50	Large T-Cat. Part 121
Beechcraft		
BE-18 Twin Beech	9	CAR 3
BE-55 Baron BE-58	5	CAR 3
BE-60 Duke	5	FAR 23
BE-76 Duchess	3	FAR 23
BE-90 King Air	10	Special Conditions Part 135.169(b)(2)
BE-100 King Air	10	Parts 23/135 Apx. A Part 135.169(b)(4)
BE-200 King Air	15	Parts 23/135 Apx. A Part 135.169(b)(4)
BE-300 King Air	15	Large T-Cat Part 135.169(b)(1)
BE-99	12	SFAR 23 Part 135.169(b)(3)
BE-1300 Airliner	13	SFAR 23 FAR 135.169(b)(3)
BE-1900	19	SFAR 41.1(b) FAR 135.169(b)(6)

TABLE 4.3.2.7. (Cont'd.)
CERTIFICATION AND OPERATING RULES FOR
TURBOPROPELLER AND RECIPROCATING,
MULTIENGINE PASSENGER AIRPLANES

Airplane	Max. Pax. Seats	Certification Category & Performance Rules
Boeing (De Havilland)		
Twin Otter (100,200,300)	10+	SFAR 23 FAR 135.169(b)(3)
DH-8	50	Large T-Cat. Part 121
British Aerospace (Hadley Page)		
Bae - 3101 Jetstream	19	SFAR 41.1(b) FAR 135.169(b)(6)
Bae - 3201 Super Jetstream	19	Commuter Category FAR 135.398
Casa		
C212-300	26	T-Cat. Part 135.397Cessna
300 Series	5	CAR 3
402	8	CAR 3
404 Titan	11	FAR 23 FAR 135.169(b)(4)
406 Caravan II	12	SFAR 41.1(a) FAR 135.169(b)(5)
414	7	CAR 3
421	7	CAR 3
Commander		
Turbine-Powered	10	CAR 3
Commuter Air Transport		
CATPASS 200 - 15	13	Part 23/Part 135 APX. A FAR 135.169(b)(4)
Dornner		
DO228-212	19	Part 23/Part 135 Apx. A FAR 135.169(b)(4)
Embraer		
EMB-110-P1 Bandeerante	19	SFAR 41.1(b) FAR 135.169(b)(6)

TABLE 4.3.2.7. (Cont'd.)
CERTIFICATION AND OPERATING RULES FOR TURBOPROPELLER AND RECIPROCATING, MULTIENGINE PASSENGER AIRPLANES

Airplane	Max. Pax. Seats	Certification Category & Performance Rules
EMB-120	30	Large T-Cat.
Brasillia		Part 135
Fairchild (Swearingen)		SFAR 23
SA 226	8	FAR 135.169(B)(3)
SA 227 - AT/41	14	SFAR 41.1(b)
Merlin IV		FAR 135.169(b)(6)
SA 227 - AC	19	SFAR 41.1(b)
Metroliner III		FAR 135.169(b)(6)
GAF		
N24A	16	SFAR 23
Nomad		FAR 135.169(b)(4)
Mooney		
MU-2	8	CAR 3
Pilatus (Britten-Norman)		
BN2B-20&26	8	Part 23/Part 135 Apx. A
Islander		FAR 135.169(b)(4)
BN2T	8	Part 23/Part 135 Apx. A
Turbine Islander		FAR 135.169(b)(4)
Piper		
All	9 or Less	CAR 3, FAR 23
Saab-Scania		
340B	35	Large T-Cat.
		Part 121
Short Brothers		
330	Large T-Cat.	
	30	FAR 135
360	Large T-Cat.	
Skyvan	36	Part 121
Volpar		
Turboliner	10+	SFAR 23
(Modified BE-18)		FAR 135.169(b)(3)

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